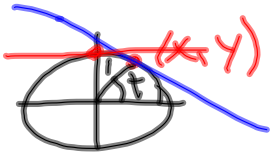
10.1 Parametric Equations

$x = f(t)$, $y = g(t)$ } t = time

- used to describe 2D motion
- graphs may not be functions

$x = \cos t$

$y = \sin t$



$\frac{dx}{dt} = -\sin t$

$\frac{dy}{dt} = \cos t$

$\frac{dy}{dx} = \frac{\cos t}{-\sin t}$

$\left.\frac{dy}{dx}\right|_{t=\pi/2} = 0$

$\left.\frac{dy}{dx}\right|_{t=\frac{\pi}{4}} = -1$

$\text{slope} = \frac{dy}{dx} = \frac{dy/dt}{dx/dt}$

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$\frac{d^2y}{dx^2} = \frac{\frac{d}{dt}\left(\frac{dy}{dx}\right)}{\frac{dx}{dt}}$

$\frac{dy}{dx} = \frac{\cos t}{-\sin t}$

$\frac{d^2y}{dx^2} = \left[\frac{(-\sin t)(-\sin t) - \cos t(-\cos t)}{(-\sin t)^2}\right]\frac{1}{-\sin t}$

$= \frac{\sin^2 t + \cos^2 t}{\sin^2 t\,(-\sin t)}$

$\frac{d^2y}{dx^2} = \frac{1}{-\sin^3 t}$

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